

Who was the first person really?

THIS MAY surprise you, but there never was a first person – because every person had to have parents, and those parents had to be people too! Same with rabbits. There never was a first rabbit, never was a first crocodile, never a first dragonfly. Every creature ever born belonged to the same species as its parents (with perhaps a very small number of exceptions, which I shall ignore here). So that must mean that every creature ever born belonged to the same species as its grandparents. And its great-grandparents. And its great-great-grandparents. And so on for ever.

For ever? Well, no, it's not as simple as that. This is going to need a bit of explaining, and

I'll begin with a thought experiment. A thought experiment is an experiment in your imagination. What we are going to imagine is not literally possible because it takes us way, way back in time, long before we were born. But *imagining* it teaches us something important. So, here is our thought experiment. All you have to do is imagine yourself following these instructions.

Find a picture of yourself. Now take a picture of your father and place it on top. Then find a picture of his father, your grandfather. Then place on top of that a picture of your grandfather's father, your great-grandfather.

You may not have ever met any of your great-grandfathers. I never met any of mine, but I know that one was a country schoolmaster, one a country doctor, one a forester in British India, and one a lawyer, greedy for cream, who died rock-climbing in old age. Still, even if you don't know what your father's father's father looked like, you can imagine him as a sort of shadowy figure, perhaps a fading brown photograph in a leather frame. Now do the same thing with his father, your great-great-grandfather. And just carry on piling the pictures on top of each other, going back through more and more and more great-great-greats. You can go on doing this even before photography was invented: this is a *thought* experiment, after all.

How many greats do we need for our thought experiment? Oh, a mere 185 million or so will do nicely!

Mere?

MERE?

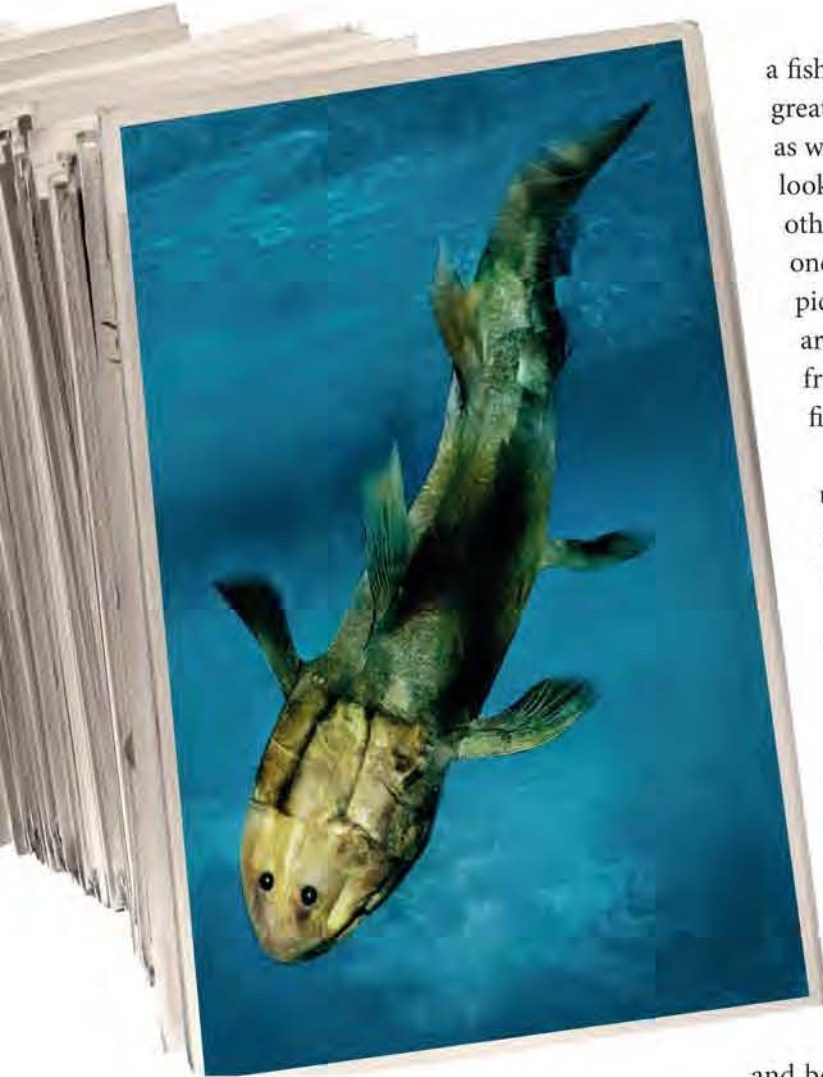
It isn't easy to imagine a pile of 185 million pictures. How high would it be? Well, if each picture was printed as a normal picture postcard, 185 million pictures would form a tower about 16,000 feet high: that's more than 40 New York skyscrapers standing on top of each other. Too tall to climb, even if it didn't fall over (which it would). So let's tip it safely on its side, and pack the pictures along the length of a single bookshelf.

How long is the bookshelf?

About three miles.

The near end of the bookshelf has the picture of you. The far end has a picture of your 185-million-greats-grandfather. What did he look like? An old man with wispy hair and white sidewhiskers? A caveman in a leopard skin? Forget any such thought. We don't know exactly what he looked like, but fossils give us a pretty good idea. Your 185-million-greats-grandfather looked something like this →





Yes, that's right. Your 185-million-greats-grandfather was a fish. So was your 185-million-greats-grandmother, which is just as well or they couldn't have mated with each other and you wouldn't be here.

Let's now walk along our three-mile bookshelf, pulling pictures off it one by one to have a look at them. Every picture shows a creature belonging to the same species as the picture on either side of it. Every one looks just like its neighbours in the line – or at least as much alike as any man looks like his father and his son. Yet if you walk steadily from one end of the bookshelf to the other, you'll see a human at one end and

a fish at the other. And lots of other interesting great-... great-grandparents in between, which, as we shall soon see, include some animals that look like apes, others that look like monkeys, others that look like shrews, and so on. Each one is like its neighbours in the line, yet if you pick any two pictures far apart in the line they are very different – and if you follow the line from humans back far enough you come to a fish. How can this be?

Actually, it isn't all that difficult to understand. We are quite used to gradual changes that, step by tiny step, one after the other, make up a big change. You were once a baby. Now you are not. When you are a lot older you'll look quite different again. Yet every day of your life, when you wake up, you are the same person as when you went to bed the previous night. A baby changes into a toddler, then into a child, then into an adolescent; then a young adult, then a middle-aged adult, then an old person. And the change happens so gradually that there never is a day when you can say, 'This person has suddenly stopped being a baby

and become a toddler.' And later on there never comes a day when you can say, 'This person has stopped being a child and become an adolescent.' There's never a day when you can say, 'Yesterday this man was middle-aged: today he is old.'

That helps us to understand our thought experiment, which takes us back through 185 million generations of parents and grandparents and great-grandparents until we come face to face with a fish. And, turning round to go forwards in time, it's



what happened when your fish ancestor had a fishy child, who had a fishy child, who had a child ... who, 185 million (gradually less fishy) generations later, turned out to be you.

So it was all very gradual – so gradual that you wouldn't notice any change as you walked back a thousand years; or even ten thousand years, which would bring you to somewhere around your 400-greats-grandfather. Or rather, you would notice lots of little changes all the way along, because nobody looks exactly like their father. But you wouldn't notice any general trend. Ten thousand years back from modern humans is not long enough to show a trend. The portrait of your ancestor of ten thousand years ago would be no different from modern people, if we set aside superficial differences in dress and hair and whisker style. He would be no more different from us than modern people are different from other modern people.

How about a hundred thousand years, where we might find your 4,000-greats-grandfather? Well, now, maybe there would be a just-noticeable change. Perhaps a slight thickening of the skull, especially under the eyebrows. But it would still only be slight. Now let's push a bit further back in time. If you walked the first million years along the shelf, the picture of your 50,000-greats-grandfather would be different enough to count as a different species, the one we call *Homo erectus*. We today, as you know, are

Homo sapiens. *Homo erectus* and *Homo sapiens* probably wouldn't have been able to mate with each other; or, even if they could, the baby would probably not have been able to have babies of its own – in the same way that a mule, which has a donkey father and a horse mother, is almost always unable to have offspring. (We'll see why in the next chapter.)

Once again, though, everything is gradual. You are *Homo sapiens* and your 50,000-greats-grandfather was *Homo erectus*. But there never was a *Homo erectus* who suddenly gave birth to a *Homo sapiens* baby.

So, the question of who was the first person, and when they lived, doesn't have a precise answer. It's kind of fuzzy, like the answer to the question: When did you stop being a baby and become a toddler? At some point, probably less than a million years ago but more than a hundred thousand years ago, our ancestors were sufficiently different from us that a modern person wouldn't have been able to breed with them if they had met.

Whether we should call *Homo erectus* a person, a human, is a different question. That's

Your 50,000-greats-grandfather



Your 4,000-greats-grandfather





a question about how you choose to use words – what’s called a semantic question. Some people might want to call a zebra a stripy horse, but others might like to keep the word ‘horse’ for the species that we ride. That’s another semantic question. You might prefer to keep the words ‘person’, ‘man’ and ‘woman’ for *Homo sapiens*. That’s up to you. Nobody, however, would want to call your fishy 185-million-greats-grandfather a man. That would just be silly, even though there is a continuous chain linking him to you, every link in the chain being a member of exactly the same species as its neighbours in the chain.

Turned to stone

Now, how do we know what our distant ancestors looked like, and how do we know when they lived? Mostly from fossils. All the pictures of our ancestors in this chapter are reconstructions based on fossils but coloured by comparing them with modern animals.

Fossils are made of stone. They are stones that have picked up the shapes of dead animals or plants. The great majority of animals die with no hope of turning into a fossil. The trick, if you want to be a fossil, is to get yourself buried in the right kind of mud or silt, the kind that might eventually harden to form ‘sedimentary rock’.

What does that mean? Rocks are of three kinds: igneous, sedimentary and metamorphic. I shall ignore metamorphic rocks, as they were originally one of the other two kinds, igneous or sedimentary, and have been changed by pressure and/or heat. Igneous rocks (from the Latin for

‘fire’, *ignis*) were once molten, like the hot lava that comes out of erupting volcanoes now, and solidified into hard rock when they cooled. Hard rocks, of any kind, get worn down (‘eroded’) by wind or water to make smaller rocks, pebbles, sand and dust. Sand or dust gets suspended in water and can then settle in layers of *sediment* or mud at the bottom of a sea, lake or river. Over a very long time, sediments can harden to make layers (or ‘strata’) of *sedimentary rock*. Although all strata start off flat and horizontal, they have often got tilted, upended or warped by the time we see them, millions of years later (for how this happens, see Chapter 10 on earthquakes).

Now, suppose a dead animal happens to get washed into the mud, in an estuary perhaps. If the mud later hardens to become sedimentary rock, the animal’s body may rot away, leaving in the hardening rock a hollow imprint of its form which we eventually find. That is one kind of fossil – a kind of ‘negative’ picture of the animal. Or the hollow imprint may act as a mould into which new sediments fall, later hardening to form a ‘positive’ replica of the outside of the animal’s body. That’s a second kind of fossil. And there’s a third kind of fossil in which the atoms and molecules of the animal’s body are, one by one, replaced by atoms and molecules of minerals from the water, which later crystallize to form rock. This is the best kind of fossil because, with luck, tiny details of the animal’s insides are permanently reproduced, right through the middle of the fossil.

Fossils can even be dated. We can tell how old they are, mostly by measuring radioactive isotopes in the rocks. We’ll learn what isotopes are, and atoms, in Chapter 4. Briefly, a radioactive isotope is a kind of atom which

decays into a different kind of atom: for example, one called uranium-238 turns into one called lead-206. Because we know how long this takes to happen, we can think of the isotope as a radioactive clock. Radioactive clocks are rather like the water clocks and candle clocks that people used in the days before pendulum clocks were invented. A tank of water with a hole in the bottom will drain at a measurable rate. If the tank was filled at dawn, you can tell how much of the day has passed by measuring the present level of water. Same with a candle clock. The candle burns at a fixed rate, so you can tell how long it has been burning by measuring how much candle is left. In the case of a uranium-238 clock, we know that it takes 4.5 billion years for half the uranium-238 to decay to lead-206. This is called the ‘half-life’ of uranium-238. So, by measuring how much lead-206 there is in a rock, compared with the amount of uranium-238, you can calculate how long it is since there was no lead-206 and only uranium-238: how long, in other words, since the clock was ‘zeroed’.

And when is the clock zeroed? Well, it only happens with igneous rocks, whose clocks are all zeroed at the moment when the molten rock hardens to become solid. It doesn’t work with sedimentary rock, which has no such ‘zero moment’, and this is a pity because fossils are found only in sedimentary rocks. So we have to find igneous rocks close by sedimentary layers and use them as our clocks. For example, if a fossil is in a sediment with 120-million-year-old igneous rock above it and 130-million-year-old igneous rock below it, you know the fossil dates from somewhere between 120 million and 130 million years ago. That’s how all the dates

